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Micro-level Rigidity vs. Macro-level Flexibility: Lessons from Finland

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Abstract

This paper explores the wage flexibility in Finland. The study covers the private sector workers by using three data sets from the payroll records of employers' associations. The data span the period 1985-2001. The results reveal that there has been macroeconomic flexibility in the labour market. Average real wages declined during the early 1990's depression and a large proportion of workers experienced real wage cuts. However, the evidence based on individual-level wage change distributions shows that especially real wages are rigid. In particular, individual-level wage changes have regained the high levels of real rigidity during the late 1990s that prevailed in the 1980s, despite the continued high (but declining) level of unemployment.

Keywords: Wage flexibility; wage rigidity; wage cuts

JEL classification: J30; J33

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I. Introduction

This paper evaluates the wage adjustment in Finland by using data from the payroll records of employers' associations.[1] The Finnish case provides particularly interesting environment to examine the wage flexibility for three reasons. First, there was an unprecedented collapse in aggregate economic activity during the early 1990s. Output fell by 14% in the years 1990-1993. The unemployment rate increased in three years (1991-1993) to almost 20% from an average around 5% during the 1980s. Thus, Finland suffered its worst depression of the twentieth century not in the 1930s but in the early 1990s (e.g. Honkapohja and Koskela 1999; Böckerman and Kiander 2002; Koskela and Uusitalo 2006; Gorodnichenko *et al.* 2009). It is possible that this shock to unemployment caused changes in the way labour markets work and affected the strictness of constraints to downward rigidity of wages.

Second, Finland has been a high-inflation country, where the rapid rate of inflation was compensated by the frequent devaluations of currency to regain competitiveness in export sectors. This traditional pattern of macro-level adjustment turned around when the Bank of Finland adopted inflation targeting after the depression of the early 1990s and the country joined to the third stage of Economic and Monetary Union in 1999. In February 1993 the Bank of Finland adopted a target rate of 2% *per annum* for the core inflation rate to be attained by 1995. The same target was upheld by the European Central Bank. The target was low given the inflation history of the three previous decades. The average inflation in Finland was 4.9% during the 1960s, 11.4% during the 1970s, and 6.8% during the 1980s.

Third, the structure of wage bargaining involves a high degree of coordination between both unions and employers, with a framework agreement being determined centrally on a one- or two-year basis, followed by union-level bargains (e.g. Vartiainen 1998). Hence, collective bargaining dominates wage formation and the coverage of collective bargains is roughly 95% of all workers, one of the highest rates in the OECD (e.g. Layard and Nickell 1999). As one outcome of the binding collective agreements, wage compression is high. Despite discussions and pressures for changes in the institutions, the wage setting practices can be described as stable over the period of analysis (1985-2001).[2]

This article is structured as follows. Section 2 provides descriptive evidence. Section 3 reports results on the incidence of wage cuts. Section 4 analyses the micro-level rigidity of wages and Section 5 focuses on macro-economic adjustment. The last section concludes.

II. Wage Changes

We use three separate data sets for the private sector workers obtained from the payroll records of employers' associations for the period 1985-2001.[3] The observed wage change distributions are presented in Figs. 1-6. The distributions are centered around the contract wage change or actual inflation each year and then averaged over the years. The figures include also a symmetrical distribution around the median bin of the averaged distribution. For the contract wage this median bin is always the zero bin. For inflation the median bin is 1 percentage point above the bin including the inflation rate. The contract wage increases

are the percentage wage changes implied by the contracts signed in each bargaining round as reported in Marjanen (2002) and they can be different for the three sectors.

Figs. 1-6 around here

In all sectors there is a peak in the distribution at the level of nominal wage increase stipulated in the collective agreements. The share of observations below the contact wage rise is substantially less than in a symmetric distribution. Hence, there is a cut-off in the distribution at the contract wage rise or just below it, and missing mass below that point. Compared to a similar distribution centered around inflation it is obvious that the contract wage rise determines the concentration of observations more than inflation. For inflation centered distribution the median bin is above the inflation bin, and there are excess observations several percentage points below the inflation rate (for the blue-collar workers this excess is smaller). Thus, the shape of wage change distribution depends mainly on general wage increase that is agreed upon in the collective agreements, and it might be dubbed as contract wage rigidity. Alternatively, these features indicate that the centralized bargaining institutions are the means that effectively produce real wage rigidity in wage setting. These same institutions may, however, also be means to secure concerted macro-level wage moderation, as discussed below.

There is not much evidence for nominal wage rigidity in annual distributions since there are no spikes at *zero* wage change for manual workers, and only very small spikes for non-manual and service sector workers.[4] However, during the depression years in 1992 and 1993 there was a wage ‘freeze’ due to a centrally bargained extension of the previously

prevailing contracts. This centralized wage freeze created a large increase of zero nominal wage changes in these years (more prominent for non-manual manufacturing workers and service sector workers; for the service sector this freeze also continued to 1994). The distributions for the non-manual manufacturing and service sector workers are highly asymmetric below zero nominal wage change suggesting the presence of downward nominal wage rigidity. However, this lack of nominal wage cuts can also be induced by real rigidity. The small zero spikes suggest that this is most likely the case.

There have been four industry-based contracts (1988, 1994, 1995 and 2000). The distributions in these years have not been very different from the histograms in surrounding years with centralized contracts, but there is some tendency that the support of the mode of wage changes is wider. This is consistent with somewhat more variation across industries in the 'average' wage change in the years of industry-level contracts. For both manual and non-manual manufacturing workers it is notable that after the depression the distributions are different from those before the depression in the sense that the distributions have become more concentrated during the late 1990s. The reason is that the Income Policy Agreements have been more comprehensive during the late 1990s as a consequence of macroeconomic difficulties, which has lead to the compression of wage changes around the level of centralized agreements.

Along with the general rise, the collective agreements also include low-wage or female allowances with a purpose of increasing the wages for some groups more than by the general rise. In addition, a mixed pay rise formula (X% or Y euros at minimum) is often applied. It produces wage compression. To examine the solidarity aspects, we regressed

annual wage changes at the individual level in current year on wage levels two years earlier, because measurement error would produce the negative effect when using wage levels one year earlier. We include a full set of year and industry indicators to focus on wage compression across individuals within industries. There is evidence for a negative relationship that supports the prevalence of solidaristic wage setting in all sectors (Table 1). Hence, low-wage workers tend to get higher wage rises within industries. The effect is much smaller for the non-manual manufacturing workers, because individual-level wage bargaining is more important among them. It is also possible that the average wage level of non-manuals is so high that the solidarity aspects do not cover them. It is likely that wage compression biases real rigidity measures downwards, because some individuals are raised above the real rigidity zone, rather than to the zone, in the wage change distribution.

Table 1 around here

The median wage change has been strongly pro-cyclical in all sectors, and the development of the medians over time reflects strongly the evolution of inflation (Fig. 7). Fluctuations in the medians have also been in other respects largely similar across sectors. This is not a great surprise, because the period is dominated by collective agreements that have produced quite similar real wage rises across sectors, based on the *average* rate of productivity growth in the economy. This is often referred to as the "wage norm". The median worker experienced real wage declines during the early 1990s. This contributed to a decline in the labour share of the total income (e.g. Sauramo 2004; Kyyrä and Maliranta 2008). Real wage increases of the median worker have also been smaller in the late 1990s compared to the late 1980s reflecting the macroeconomic difficulties of the 1990s.

Fig. 7 around here

III. Wage Cuts

It is a general presumption that centralized collective bargaining leads to compression in both wage levels and wage changes. There is evidence for this in Finland, but there is still considerable heterogeneity in wage changes. One indication of this is the existence of nominal wage cuts and the differences in their incidence across sectors. For non-manual workers in manufacturing and for the service sector workers, nominal wage cuts are rather rare, in spite of the depression, with annual incidence of nominal wage cuts in the range from 1 to 5 per cent (Table 2). In contrast, nominal wage cuts are much more frequent for manual workers in the manufacturing sector, the incidence reaching 36 per cent in 1991-1992, and above 20 per cent in 1992-1993 and 1996-1997. There is also evidence that during the depression years downward wage adjustment started earlier for manual workers and continued longer in the service sector compared to non-manual workers.

Table 2 around here

The share of workers experiencing real wage cuts behaves remarkably similarly across sectors, being very high (60-80%) in 1991-1993. This pattern emerges from a large number of nominal wage increases that lie between zero and the inflation rate. This holds especially for the non-manual and service sector workers, which explains the larger difference between the shares of real and nominal wage declines for these groups. Nominal wage

moderation with the positive inflation rate during the depression made it possible to implement real wage cuts for a large share of workers without implementing aggregate nominal wage cuts by the collective agreements. Hence, centralized bargaining allowed for at least some downward adjustment of real wages.[5] The brief economic slowdown that started in 1996 provides corroborating evidence for this. The bargaining system responded to this slowdown by postponing wage rises in 1997, which is shown in the substantial number of real wage cuts from 1996 to 1997.

The estimates from probit models can be used to evaluate the factors that have contributed to wage cuts. The models reported in detail in Böckerman *et al.* (2007) include individual characteristics (such as gender, age and working hours) and employer characteristics (such as plant size and industry) as explanatory variables for the probability of the individual worker experiencing a wage cut. The results show that full-time workers have a lower likelihood of nominal and real wage decline. The service sector workers that work less than 30 hours weekly are around 4 per cent more likely to experience a nominal wage cut. The effect is even larger for real wage reductions, which are around 9 per cent more likely for part-time workers compared with full-time workers. For manuals and non-manuals in manufacturing these effects are in the range of 1-3 per cent. The pattern is consistent with the efficiency-wage explanation and the fairness standards as an obstacle to wage cuts (Bewley 2007). Full-time workers are more important for the productivity of a firm compared with the part-time workers and hence they have a stronger bargaining position to prevent a wage cut, and firms are more afraid of a reduction in their productivity. The

fairness standards can also be tighter for the full-time insiders because of stronger attachment with the firm.

Wage cuts are also more common in small plants. Depending on the sector, real wage cuts are around 5-8 per cent more likely in small firms compared with large firms. For nominal wage cuts this firm size effect is about 1-5 per cent. This result is in disagreement with fairness as an obstacle to wage cuts. Fairness standards should be stricter in small plants, because there are more repeated personal interactions between the employer and workers. However, the size of a plant can matter for other reasons. It is possible that the effective bargaining power of unions is weaker in small plants. Thus, unions are less able to resist wage cuts in small plants that concern firm-specific wage components that do not compromise the minimum standards stipulated in the collective agreements. Another explanation is that greater loyalty in small plants between the workforce and the employer can make it easier to cut wages in order to save jobs.

IV. Micro-level Rigidity

Dickens *et al.* (2007) present the method used for the estimation of wage rigidities in the International Wage Flexibility Project (IWFP), and discuss its features. We use the protocol developed in IWFP to measure nominal and real rigidities in wage setting. We concentrate on the results based on the estimated ('true') wage change distribution that is corrected for measurement errors in the data, rather than on the observed distribution.[6] Generalized method of moments is used to fit a model of wage changes to the error-corrected wage

change histograms. The method uses the fraction of observations in each cell of the wage change histogram as the moments. The model assumes that, in the absence of rigidity, log wage changes have a symmetric two-sided Weibull distribution, which is referred to as the notional wage change distribution.[7] Hence, in the absence of wage rigidities, the mean wage change equals the median wage change. Therefore, all deviations from the symmetry are caused by nominal and real wage rigidities. The measures are proportions of workers that are actually subject to particular type of rigidity of those workers that are potentially subject to the rigidity considered.[8] The measures for wage rigidities vary between 0 and 1. A value of 0 indicates perfect flexibility (no one is subject to rigidity) and 1 indicates perfect rigidity (all workers potentially subject to rigidity are affected by it). The definition of nominal wage rigidity is the fraction of workers who are not affected by downward real wage rigidity, but who are affected by downward nominal wage rigidity. Thus, there is no *a priori* reason for the measures of nominal and real rigidity to be negatively correlated.

We describe the results for the amount of rigidities as average values over several years, because there have been substantial fluctuations in the measures from year to year. One reason for the fluctuations is that it may be difficult to distinguish the effect of real wage rigidity from the effects of collective bargaining on wage determination. Centralized wage bargains set a floor for wage changes while allowing decentralized firm-level changes above the floor, often called “wage drift”. The spike will then reflect the negotiated minimum real wage change rather than the expected rate of inflation only. The protocol restricts the expected rate of inflation to fall within reasonable bounds. Then owing to wage drift, it is possible to estimate considerable real wage rigidity in years when the floor falls within a preset range for expected inflation, but not in years when the floor is above that

range. Another reason is that it may be difficult to separate nominal and real wage rigidity from each other during the years of very low inflation, i.e. during most of the late 1990s. However, this distinction is less relevant when inflation is very low, because the effects of nominal and real rigidities on wages are essentially the same.

We use three periods; the late 1980s (1986-1990), the early 1990's depression years (1991-1993/1992-1994), and the late 1990s (1994-2000/1995-2001). The results show that the amount of nominal rigidity has been quite low in all sectors, but it rose considerably during the depression (Table 3, Panel A). This reflects the nominal wage freeze implemented by the collective agreements during the depression. The level of nominal rigidities was highest in the service sector, and smallest in the manual manufacturing sector. In contrast, averages of real rigidities reveal that the amount of real rigidities in wage changes has been smallest during the depression (Table 3, Panel B). The level of real rigidities was lowest in manual manufacturing and service sectors during this period. The amount of real rigidities has been highest for non-manual manufacturing workers in the late 1980s and the late 1990s. It is also notable that in the late 1990s the level of real rigidity has increased back to the late 1980's levels, despite much higher level of unemployment during the late 1990s. On the other hand, this pattern over time in real rigidity and unemployment makes it difficult to argue that real wage rigidities are the direct cause of unemployment.

Table 3 around here

All in all, there has been a great deal of either real or nominal rigidities in all sectors in most years. However, the constraint of real rigidity on wage determination was relaxed

during the depression. On the other hand, nominal rigidity increased and therefore formed the ultimate limit to downward wage flexibility.

V. Macro-level Flexibility

To analyse the real consequences of downward nominal wage rigidity and inflation Nickell and Quintini (2003) regress the share of negative real wage change on the inflation rate. The control variables include the median of real wage changes and the dispersion of real wage changes. Their results using UK New Earnings Survey over the period 1976-1999 show that an increase in the rate of inflation produces an increase in the share of workers that experience negative real wage change. This result implies that downward nominal rigidity and low inflation together prevent the downward adjustment in real wages.

We estimate Nickell and Quintini type regressions for manual manufacturing workers.[9] The baseline model shows that the rate of inflation is not statistically significant in explaining the share of workers that have experienced negative real wage changes (Table 4, Column 1). This is not surprising, because the share of negative real wage changes was particularly high in manufacturing during the depression when inflation was declining (Table 2). Hence, the result could be an anomaly related to the depression and associated disinflation. When we include an indicator for the years 1991-1993 the relationship between inflation and the share of workers that experience negative real wage changes is positive and statistically significant at 10% level (Table 4, Column 2). The quantitative magnitude of the impact is about twice as large as the one reported by Nickell and Quintini (2003) for the UK. This magnitude may still be too modest to provide an argument for raising long-run inflation

target, but it suggests that lower inflation (target) together with downward nominal wage rigidity have had some real wage effects.

Table 4 around here

As a further look at the macroeconomic flexibility of wage setting to economic conditions we estimate simple Phillips curves or wage equations. (Pehkonen 1999 provides earlier estimates.) That is, we regress the average changes in nominal wages on unemployment, productivity growth and expected inflation. We also use these regressions to evaluate the idea that downward rigidity of wages makes the adjustment of wages to economic conditions less flexible. Since downward wage rigidities mean that wage change distributions become asymmetric by shifting the negative nominal and real wage changes upward in the distribution, it means that the average wage change is higher with rigidities than without them. If the average wage change responds negatively to unemployment, the wage changes will become more constrained from below by rigidities when unemployment is higher. This implies that the response of average wage change to unemployment is smaller than without rigidities. We look at this effect by using the mean wage change from the estimated notional wage change distribution as the dependent variable in addition to the observed mean wage change. As noted earlier, the notional wage change distribution is a counterfactual distribution that would appear in the absence of rigidities for wage changes. It is symmetric around the mean change. If downward rigidities in wages prevent the adjustment of wages to economic conditions, the unemployment coefficient should be larger (in absolute value) in a regression for the estimated mean of notional wage change

distribution, compared to the coefficient for the observed mean. The estimated mean of notional wage changes and expected inflation originate from the protocol of IWFP.

We report the results from the data in which we have pooled all sectors in Table 5. The lagged productivity growth is more significant than the current one, so we use it. The past observed productivity growth is probably taken into account in wage negotiations rather than the expected productivity growth during the contract period. For the service sector productivity growth is lagged two years as it seemed to work best. This indicates that the wage setting in services follows that of manufacturing sector's by one year lag. The most important finding is that a significant negative relationship between wage growth and unemployment emerges. The effect of unemployment on the observed mean wage change is -0.4 in Column 1. The estimate is very close to what has been reported for Finland earlier (Uusitalo 2005). We also find that the effect of unemployment on the estimated mean wage change in Column 2 is almost the same as the one of the observed mean wage change. This is in contrast to the idea that the responsiveness of wages to unemployment is prohibited by downward wage rigidities. The observed wage changes seem to adjust to unemployment in the same way as the notional wage changes that are not affected by rigidities.[10] Productivity growth affects wage changes positively, with a coefficient of 0.5 in both of the models. The industry-level bargains increase wage growth by 2 percentage points compared to years with centralized bargains, a result consistent with the earlier evidence (Uusitalo 2005).

Table 5 around here

The measures for wage sweep up capture the extra amount of wage growth that arises because of downward wage rigidity. They can be included as additional variables in explaining unemployment to learn about the consequences of micro-level rigidities (see Dickens *et al.* 2007). The average wage sweep up can be interpreted as the increase in average labour costs due to downward wage rigidity. If firms are sensitive to unit labour costs, then a higher average wage sweep up should be associated with lower employment or higher unemployment, as predicted by the model of Akerlof *et al.* (1996). In our baseline estimations that pool all sectors, sweep up due to nominal rigidity obtains the expected positive coefficient but sweep up due to real rigidity obtains a negative coefficient (Table 6, Columns 1-2). However, the time pattern of sweep up measures shows that their behaviour is related to the changes during the early 1990s. The sweep up measures seem to reflect the reaction of collective bargaining to the changes in unemployment rather than the effects of rigidities on unemployment. Nominal wage freeze emerged as a reaction to the increase in unemployment in the early 1990s. This lead to higher nominal sweep up but to lower real sweep up as real wage rigidities were relaxed. Consistent with this interpretation, the amount of real wage sweep up gradually increased during the late 1990s as unemployment gradually decreased. After adding indicators for the wage freeze years, all statistically significant results regarding the sweep up measures disappear (Table 6, Columns 4-6). This confirms that the significance is driven by the depression years (The results using the sweep up measures that are based on different assumptions about the expected value and the variance of inflation produce similar findings.)

Table 6 around here

Taken together, we do not find evidence that the notional mean wage change would be more sensitive to unemployment than the observed mean wage change. Furthermore, the extra wage growth due to wage rigidities is not correlated with any extra unemployment. This indicates that although the measured micro-level real rigidity is high, it is not notably undermining the adjustment of average wage changes to economic conditions.

VI. Conclusions

This paper studied the micro and macro flexibility of wages in Finland. We covered the private sector workers by using three data sets from the payroll records of employers' associations. Two main conclusions emerge. First, there has been macroeconomic flexibility in the labour market. This means that average wage changes negatively respond to an increase in unemployment and the downward real rigidity measure declined during the worst years of the early 1990's depression. Consistent with this, a large number of workers experienced a decline in their real wage as unemployment soared. This was put into effect by wage moderation through collective agreements. However, nominal wage rigidity increased during the depression and formed the ultimate limit to downward wage flexibility. Accordingly, we found that lower inflation exacerbates real consequences of downward nominal wage rigidity. Second, the evidence based on individual-level wage change distributions reveals that real wages are in general very rigid. Because of the dominance of collective bargaining, the contract wage rise constitutes a clear cut-off in the distributions. Hence, it is difficult to separate real wage rigidity from contract wage rigidity. Alternatively, this indicates that the centralized bargaining institutions are the means that effectively produce real wage rigidity. However, the same institutions have allowed for

average wage changes to respond to economic conditions. The evidence also points out that individual-level wage changes have regained the high levels of real rigidity during the late 1990s that prevailed in the 1980s, despite the continued high (but declining) level of unemployment.

Regarding the future of wage formation, it is interesting to note that after the depression union density has declined by more than 10 percentage points in less than ten years. This rate resembles the decrease in the union density during the Thatcher years in the UK (Böckerman and Uusitalo 2006). However, this has not led to any increase in real micro-level wage flexibility, because the union contacts are still almost always extended to non-members.

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Table 1. *The sensitivity of wage changes to the lagged wage level*

Dependent variable: wage change (*t*)			
	Manual manufacturing	Non-manual manufacturing	Service sector workers
Wage level (*t*-2)	-0.044***	-0.008***	-0.037***
t-value	(-94.02)	(-44.59)	(-71.46)
N	815 976	877 749	1 162 380

Notes: t-values in parentheses. Significance indicated by *** (1%), ** (5%), * (10%). All models include a full set of unreported indicators for industries and years.

Table 2. *The share of workers that have experienced negative wage changes*

	Nominal wage			*Real Wage*		
	Manufacturing	Manufacturing	Services	Manufacturing	Manufacturing	Services
	Manual workers Hourly pay	Non-manual workers Monthly pay	Monthly pay	Manual workers Hourly pay	Non-manual workers Monthly pay	Monthly pay
1990-1991	16.9	2.0	2.4	60.1	47.8	20.8
1991-1992	36.4	2.7	5.4	69.5	87.2	81.5
1992-1993	20.6	5.4	3.9	57.8	74.4	83.1
1993-1994	8.4	1.4	4.7	11.8	14.5	69.8
1994-1995	5.0	1.2	2.7	6.5	2.3	4.2
1995-1996	10.4	3.3	2.8	12.3	4.8	4.0
1996-1997	23.3	2.7	4.8	48.2	61.3	74.3
1997-1998	11.4	1.3	3.4	18.7	6.4	5.7
1998-1999	11.4	3.5	3.9	17.5	7.6	6.1
1999-2000	6.8	1.6	3.4	33.7	34.9	38.6

Notes: Real wage change is based on actual inflation measured as the annual change in the cost-of-living index by Statistics Finland.

Table 3. *The amount of nominal and real wage rigidities (averages over several years)*

Panel A. Nominal wage rigidities			
	Manual manufacturing	Non-manual Manufacturing	Services
The late 1980's	0.00	0.29	..
The early 1990's depression	0.44	0.69	0.98
The late 1990's	0.06	0.31	0.25
Panel B. Real wage rigidities			
	Manual manufacturing	Non-manual Manufacturing	Services
The late 1980's	0.29	0.73	..
The early 1990's depression	0.04	0.23	0.00
The late 1990's	0.60	0.70	0.47

Notes: The late 1980's are 1986-1990, the depression years are 1992-1994 for services and 1991-1993 for other sectors. The late 1990's are years 1994-2000 (1995-2001 for services). The estimates are calculated by using the protocol by Dickens *et al.* (2007).

Table 4. *Nickell and Quintini type regressions for the manufacturing manual workers*

Dependent variable: the share of negative real wage changes		
Median of real wage change	-5.42**	-4.36**
	(-4.26)	(-3.86)
Dispersion of real wage changes (P75-P35)	-0.96	1.39
	(-0.22)	(0.38)
Inflation rate	1.49	1.61*
	(1.54)	(2.01)
Change in inflation rate	-1.55	-0.43
	(-1.15)	(-0.36)
Dummy for the recession years (1991-1993)	..	0.13**
		(2.70)
N	19	19
Adjusted R^2	0.80	0.86

Notes: t-values in parentheses. Significance indicated by ** (5%), * (10%).

Table 5. *The sensitivity of wage changes to unemployment*

	Observed mean	Estimated mean
Unemployment (*t*)	-0.440**	-0.426**
	(-5.33)	(-4.24)
Productivity growth (*t*-1)	0.485**	0.503**
	(4.11)	(3.50)
Expected inflation (*t*)	-0.144	-0.222
	(-0.60)	(-0.76)
Industry-level bargain	0.018**	0.020**
	(3.35)	(2.96)
N	41	41
Adjusted R^2	0.75	0.67

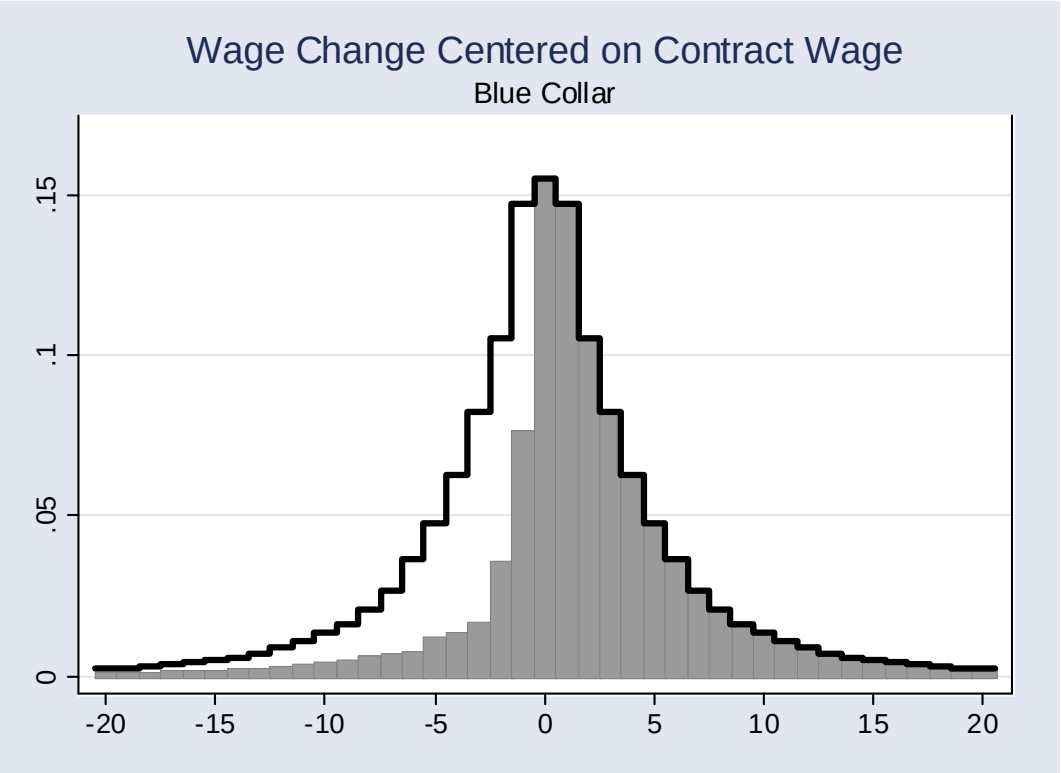
Notes: Unreported indicators for the sectors and a constant are included. *t*-values in parentheses. Significance indicated by *** (1%), ** (5%), * (10%). The estimated mean and expected inflation are calculated by using the protocol by Dickens *et al.* (2007).

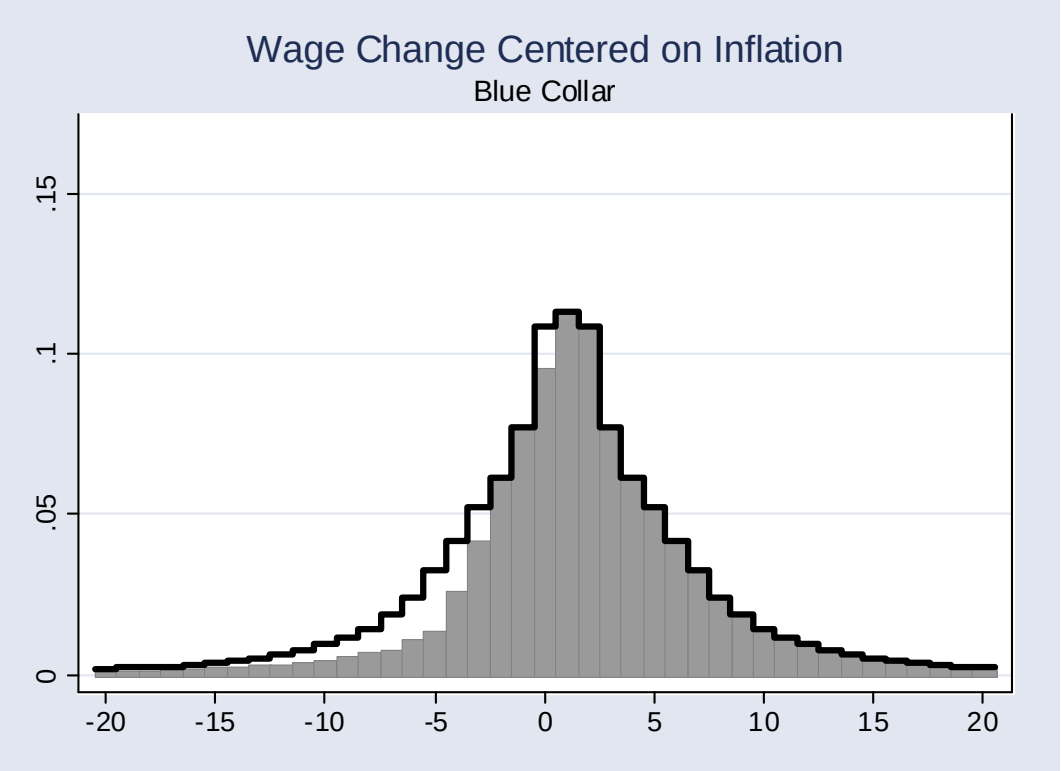
Table 6. *Sensitivity of unemployment to sweep up due to nominal and real wage rigidity*

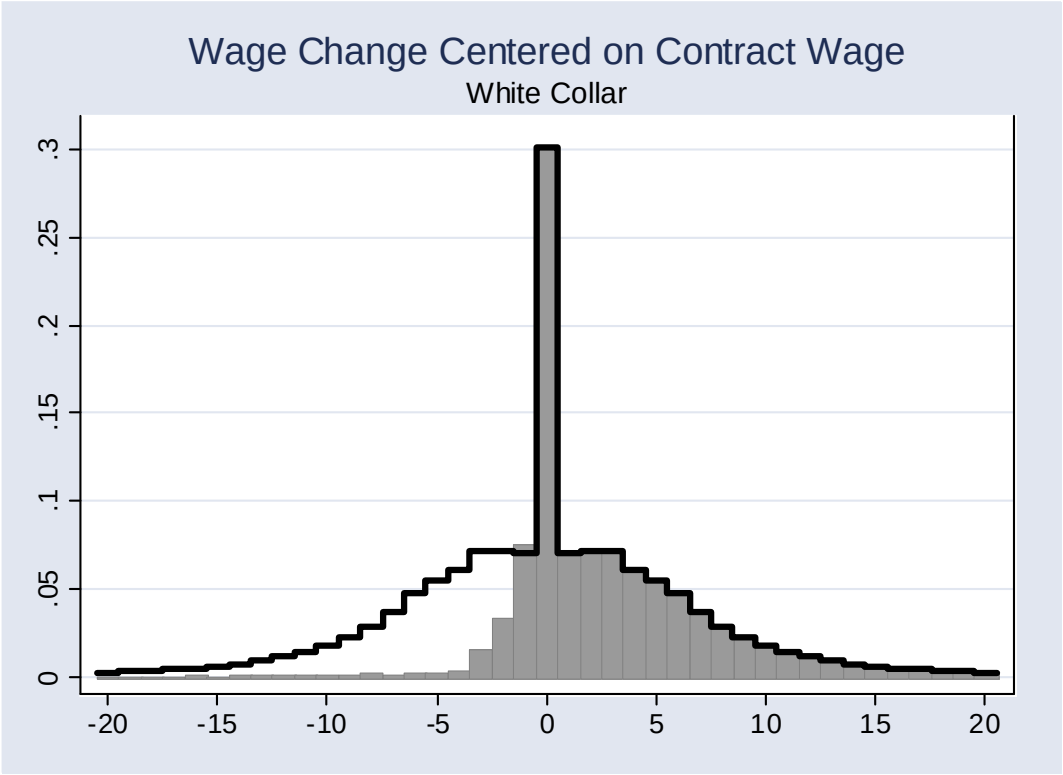
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	-2.20***	-2.29***	-2.34***	-2.14***	-2.16***	-2.24***
Wage freeze indicators	..	..	..	0.03**	0.02*	0.03***
S-up-N	0.72*			-0.26		
S-up-R		-0.91**			-0.18	
Sum			-0.33			-0.90
N	41	41	41	41	41	41
Adjusted R^2	0.75	0.76	0.72	0.77	0.77	0.78
Overall R^2	0.79	0.80	0.76	0.81	0.81	0.82

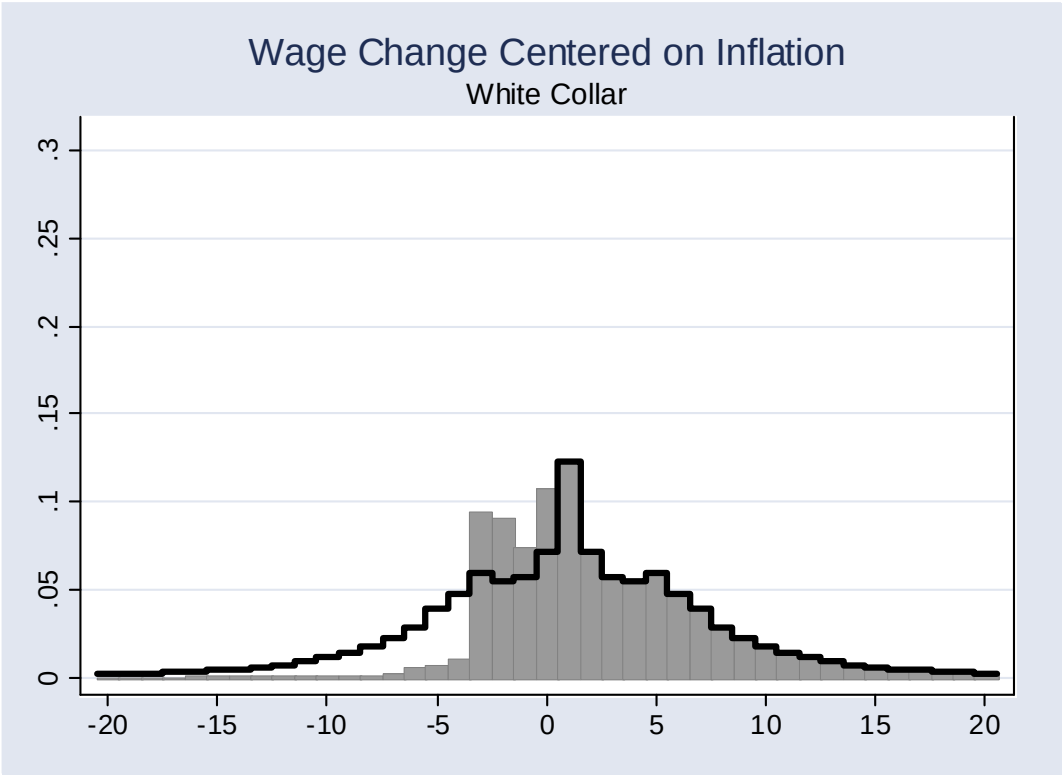
Notes: S-up-N is the magnitude of sweep up due to nominal rigidity computed as -n×(average notional wage change for those with notional wage changes less than or equal to zero)×(fraction with notional wage changes less than or equal to zero). S-up-R is the magnitude of sweep up due to real wage rigidity assuming that the median of the observed wage change distribution is equal to the mean of the notional wage change distribution, and that the mean of the true wage change distribution is equal to the mean of the observed wage change distribution. It is computed as (mean wage change - median wage change - nominal sweep up). Sum is the sum of S-up-N and S-up-R. The estimates for the amount of sweep up are calculated by using the protocol by Dickens *et al.* (2007). Wage freeze indicators in models 4-6 obtain value one for the years 1992, 1993 and 1997 in manufacturing and for the years 1993, 1994 and 1997 in services. Unreported indicators for the sectors and a constant are included. Significance indicated by *** (1%), ** (5%), * (10%).

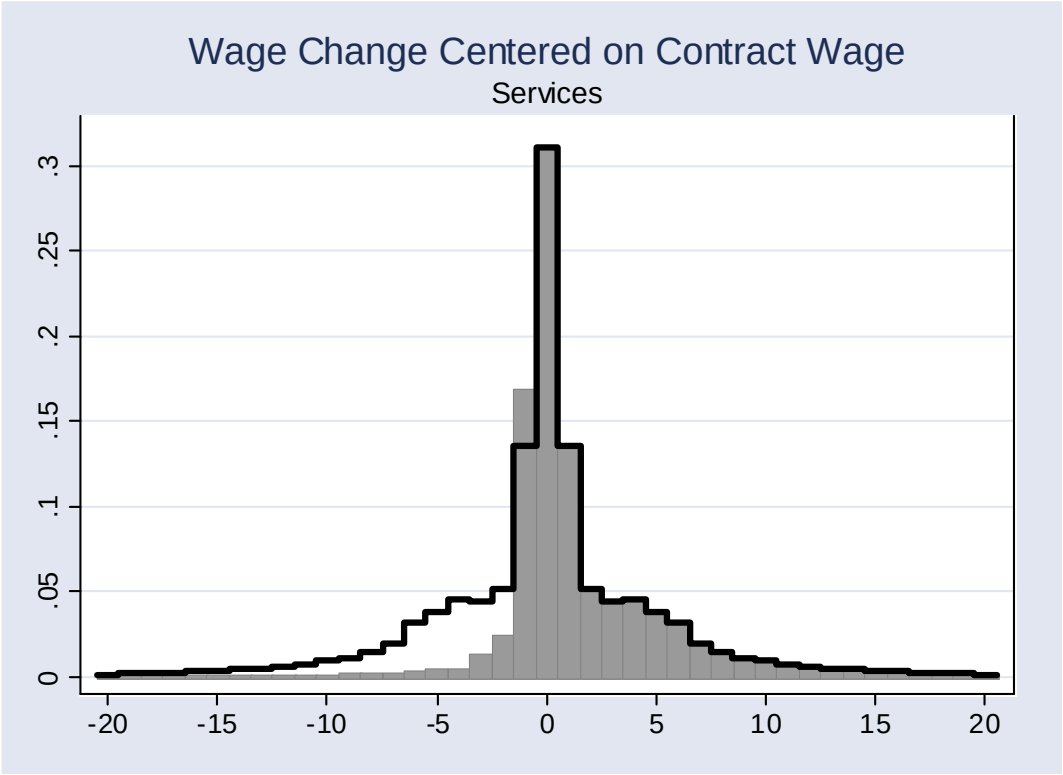
Figs. 1-6. Wage change distributions

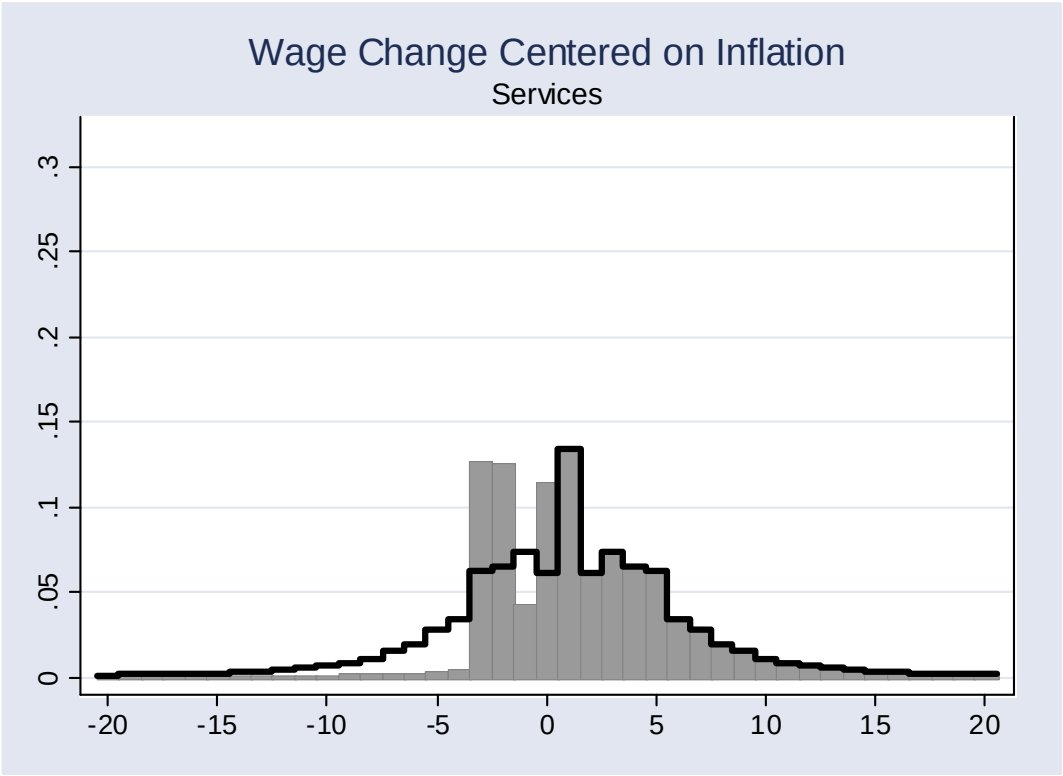





Wage Change Centered on Contract Wage
White Collar
0
.05
.1
.15
.2
.25
.3
-20
-15
-10
-5
0
5
10
15
20


Wage Change Centered on Inflation
White Collar
0
.05
.1
.15
.2
.25
.3
-20
-15
-10
-5
0
5
10
15
20


Wage Change Centered on Contract Wage
Services
0
.05
.1
.15
.2
.25
.3
-20
-15
-10
-5
0
5
10
15
20


Wage Change Centered on Inflation
Services
0
.05
.1
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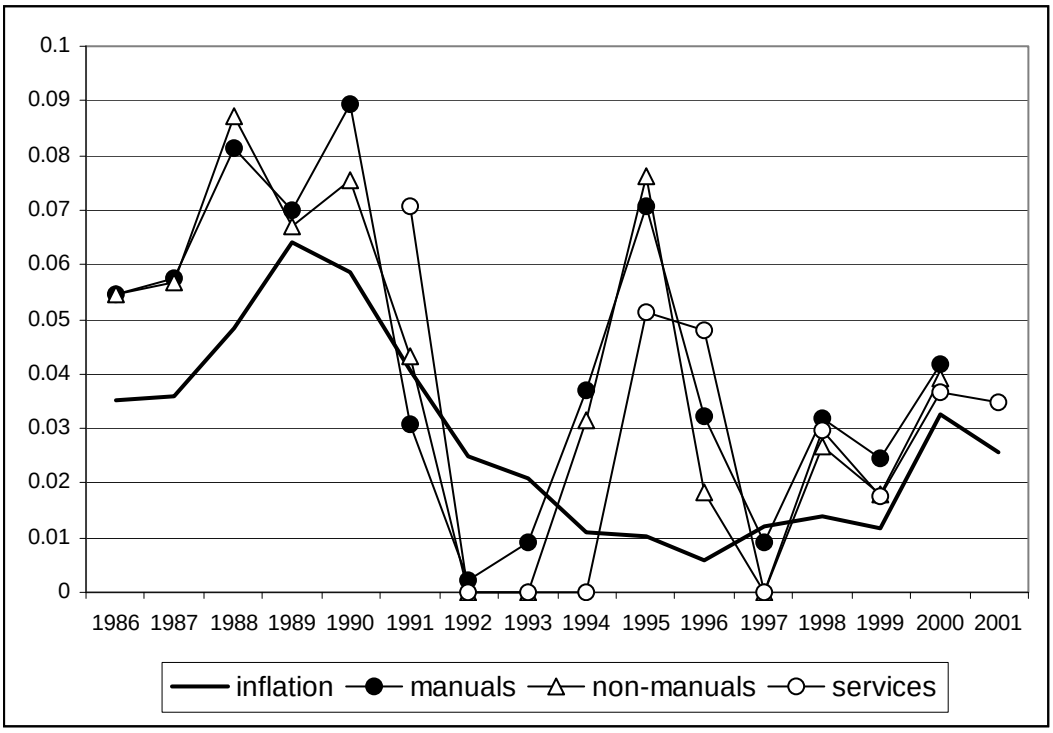
.25
.3
-20
-15
-10
-5
0
5
10
15
20

Fig. 7. Actual inflation and the median wage change by sector



Appendix A: Data description

We use ‘wage surveys’ of two Finnish employers’ associations. Manufacturing sector manual (hourly paid) blue-collar workers and non-manual (salaried, monthly paid) white-collar workers are covered by TT (*Teollisuus ja työnantajat*). The private service sector workers are covered by a survey of PT (*Palvelutyönantajat*). Wage information in these surveys originates directly from the payroll records of companies. Thus, they can be characterised as administrative or register based data. These data are very accurate, and the measurement error in surveys of individual workers, like recall or rounding error, is not a significant problem.

The survey frame of the data consists of the member firms of both associations in each reference period. Although the survey is mandatory for firms with over 30 workers (the limit varies somewhat by industry), some non-response will occur. This is concentrated on smaller firms that are also less often members of the associations. The coverage of the TT data is better than that of PT, since service firms are smaller on average. To identify employers in TT data there are firm codes and ‘response-unit’ codes. There has been a break in the firm coding system during our observation period, but the response unit codes are consistent over time. Thus, we use those to identify the employer of individuals. The response-unit refers to the establishment of a firm. In the service sector only the firm code exists in the data, so we use it.

The data are well representative at the worker level, since the TT/PT firms have good electronic systems for collecting wage data. There are some missing or erroneous identity codes. Those individuals are excluded from wage changes. However, after the early 1980s these problems are very rare.

The structure of these data is quite similar across sectors. They provide information about wages and working time, and some information about workers' individual characteristics (such as age and gender). However, there are two major differences in these data sets across the sectors: the timing of observations and the wage concept. For manual manufacturing workers the data covers the situation during the last quarter of each year for the period 1981-2000, but the situation during one month of each year for non-manual (salaried) manufacturing workers (September before 1993 and December in and after 1993) for the period 1985-2000 and the private service sector workers (August before 1995 and October in and after 1995) for the period 1990-2001. This change-over causes no major problems because the observation month is delayed and there is a point of normal contractual wage increase between the two observations (otherwise we might overestimate downward rigidity). We might underestimate the rigidity by lengthening the observation interval if more than the usual one or two annual contract wage rises fell on the interval. However, this is not the case for either sector. The observation interval changes only by two or three months, so the change-over years should be comparable to other years.

The wage concept differs across sectors. *Hourly rate* has been applied for manual workers in manufacturing, whereas *monthly rate (salary)* for non-manual workers in manufacturing and for service sector workers. The monthly rate for non-manual workers in manufacturing is defined as '*the fixed basic monthly salary paid for regular working time*'. This fixed salary is based on the 'demands' of the job or tasks performed in it and the contract-based wages determined for these 'demand classes' of jobs, and an additional person-specific component based on personal competence. Respectively, in services the monthly rate is defined as the '*personal wages paid for regular working*

time', which is very close to the former definition. It includes such *personal and 'task' specific bonuses* (merit pay), which are paid at the *same amount in each month*. These monthly wages exclude such components of wages, which are inherently chancing or are not part of the 'basic wage' of a person. Excluded are among others overtime pay, shift work, evening or Sunday bonuses, fringe benefits, and performance based payments, commissions, 'profit sharing' and similar payments. It should be noted, that the monthly wage is not simply a 'minimum' salary based on contracted wage scales, but includes a person-specific component. Firms and local unions can also agree on firm-specific wages that exceed the minimum requirements of national contracts. Such firm-specific arrangements can be reduced by mutual consent of the firm and local union. These person and firm-specific components in wages provide possibilities for both upward and downward flexibility in wages.

For measuring hourly rate for manufacturing manual workers there are two options: the wage per hour for regular working time, or the wage per hour for straight time work (time-rate). We use the time-rate, because it is a better measure of the person's 'basic' wage. The regular-time measure includes compensation from all types pay, that is, time-rate, piece-rate and performance based pay. Therefore, it can change if the structure of hours of work performed as time work, piece-rate work or performance work change. Such wage changes reflect changes in person's work effort which is problematic for the purposes of studying downward rigidity of wages. A wage cut arising from less hours or less effort in piece-rate work is not what is meant by flexible wages, which refers to changes in the 'basic wage' of persons. Therefore, we use the hourly wage measure for time-rate work. It is *calculated by dividing the wage bill for time-rate hours by hours worked on time-rate.* Wages and hours are those earned and worked during the fourth

quarter of each year. This hourly wage measure excludes piece-rate and performance work, overtime pay (and hours), and shift work, evening, night and Sunday bonuses, as well as bonuses based on working conditions. It includes any firm-specific wages paid above minimum contracts, and any 'personal bonus' incorporated in each person's individual 'wage rate per hour' that is used in remuneration for his/her time-work. Again, these person and firm-specific components in wages provide possibilities for both upward and downward wage changes, and deviations from the wage changes in centrally negotiated contracts.

A drawback of using the time-rate hourly wage is that it leads to the omission of small number individuals from the data, who are 100% paid on piece-rate or performance pay. The straight time hourly wage can also be based on few hours, but it is not clear that this should produce any problems as such, as long as the wage bill and hours data are otherwise accurate.

The wage changes are constructed for job stayers, that is, only workers who have the same employer and the same occupation during the two consecutive years are included. It is standard in micro-level studies of wage rigidity to restrict to the wage changes of persons who remain in the same job (e.g. Bewley 2007). Wage changes related to job promotions or demotions and employer switches reflect changes in job tasks, working conditions and location amenities, which contaminate measurement of wage rigidity. To control for the variation arising from changing working hours for non-manual and service sector workers' monthly wages, it is required that the "regular weekly hours" are the same in both years.

[1] This paper is based on the analyses of the project Wage Rigidity and Labour Market Effects of Inflation financed by the Finnish Work Environment Fund. Part of the results draw upon work conducted in the International Wage Flexibility Project. We are grateful for the IWFP leaders and partners for co-operation and comments. All errors remain our responsibility.

[2] The centralized framework was abandoned only during 2008-2009 wage negotiations. Employers' associations repealed their central organization the right to agree upon wage contracts with corresponding workers' organization.

[3] Appendix A provides a description of the data sources. Uusitalo and Vartiainen (2008) examine the changes in wage structure in Finland by using the same data.

[4] Böckerman *et al.* (2006) document the annual distributions.

[5] There was an attempt by the social partners to *cut* nominal labour costs by 7% in 1991 in order to avoid currency depreciation. (The proposition to cut labour costs by 7% included 3% cut in nominal wages and 4% transfer of pension contributions from employers to workers.) However, this attempt failed because two major unions delayed their support for the pact and the financial markets forced the Bank of Finland to abandon the fixed exchange rate in November 1991. After that episode the labour market organizations did not accept any cuts in nominal wages, but agreed, for the first time since the Second World War, to a two-year social pact without any nominal pay rises.

[6] The procedure assumes that the true wage change is not autocorrelated, which implies that all autocorrelation in wage changes is due to measurement error. The estimated measurement error rate for manufacturing white-collar and the service sectors is around 0.05 whereas it is much higher in the blue-collar manufacturing data, being 0.25 for this sector. The most likely reason for this is the different wage concept, which is the hourly wage rate for blue-collars as opposed to monthly salary for other sectors.

[7] Details for the justification of using Weibull distribution can be found in Dickens *et al.* (2007). Briefly, examination of the wage change distributions in the IWFP project (and some other researchers) indicates that wage change distributions are more peaked and have fatter tails than the normal distribution. Second, the upper half of the distribution (above median), which is presumably not affected by wage rigidities, is well approximated by a Weibull distribution.

[8] To quantify the amount of rigidities it is necessary to make additional assumptions about the way that wage rigidities transform the notional wage change distribution to the observed distribution. Without rigidities we would observe the notional wage change distribution which is assumed to be symmetric. A fraction of the population is subject to downward real wage rigidity, if their notional wage change is below the expected rate of inflation, and they receive a wage change equal to that expected rate of inflation rather than equal to their notional wage change. The mean and standard deviation of the expected rate of inflation in each year are parameters of the protocol and they are estimated separately for each year. We use estimates in which the expected value and the variance of expected inflation are both constrained (standard deviation constrained to be less than 0.6%). A fraction of the population is also potentially subject to downward nominal wage rigidity. Such workers who have a notional wage change less than zero, and who are not subject to downward real wage rigidity, but who receive a wage freeze instead of a nominal wage cut, are affected by downward nominal rigidity. See Dickens *et al.* (2007) for details.

[9] We use the data for manual manufacturing workers, because the data are available for a longer period (1981-2000) only in this sector, which is necessary to have enough variation in inflation.

[10] We have estimated all models also with observed median wage change. The results are very close to those with observed mean.